

## The Role of Extraterrestrial Materials in the Origin of Life

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It has been well established for some time now that C-rich organic materials are relatively common in a number of environments in space. This is known through the telescopic detection of these materials using spectroscopy techniques in the infrared and sub-millimeter wavelength ranges and through the identification of organics in extraterrestrial materials. Extraterrestrial materials in which organics have been found include collected meteorites and interplanetary dust particles, and samples returned by NASA spacecraft from comets.

These organics are produced by a variety of astrochemical processes. Despite their abiotic origins, these organic materials of are considerable interest to astrobiology for several reasons. First, organic materials of any composition are important as a means of delivering the elements C, H, O, and N to the surfaces of newly formed planets, and these elements are likely critical to the origin and subsequent evolution of life (certainly for life as we know it). In addition, it is clear that at least a portion of the organics found in space are in the form of molecules that play important roles in modern biology - for example, molecules like amino acids, amphiphiles, quinones, etc. Thus, the delivery of extraterrestrial organics to planetary surfaces brings not only bulk C, H, O, and N, but also molecular complexity in forms that are potentially useful for the origin and early evolution of life.

This suggests that the production and delivery of cosmic organic compounds may have played key roles in the origin of life on Earth and, by extension, on other planets in the universe.